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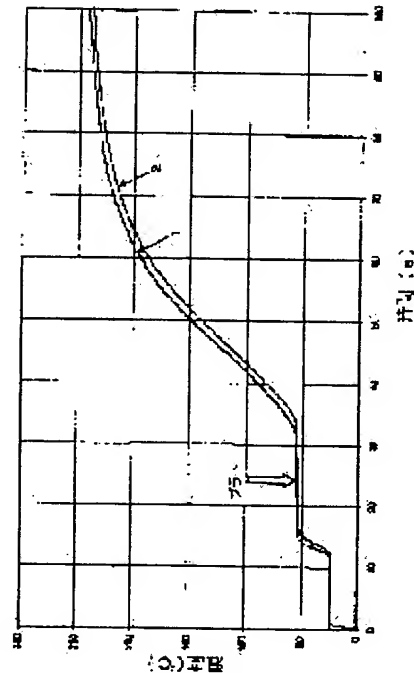
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(54) METHOD OF CALIBRATING TEMPERATURE SENSOR

(57)Abstract:

PROBLEM TO BE SOLVED: To provide various methods which expand the effectiveness of a temperature sensor as well as enhances the accuracy of temperature measurement.

SOLUTION: The behaviors of the maximum and minimum aging with lapse of time of the temperature sensors, which are constituted identically, are previously checked in accordance with the electrical parameters of the temperature sensors which are identically constituted. The checked behaviors of the aging are stored in software and the temperature sensors arranged in the exhaust gas conduits of automotive vehicles are calibrated by the same.



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CLAIMS

[Claim(s)]

[Claim 1] It is the proofreading method of the temperature sensor arranged inside. the exhaust gas of the motor vehicle which has a catalytic converter -- a conduit -- Leave the start between the colds and transition of temperature is measured on its lower stream of a river within a catalytic converter. This decides the plateau of temperature. the measured temperature value of the plateau of temperature the value of the plateau of the temperature beforehand measured by the proofread temperature sensor or new temperature sensor -- comparing -- and the difference of both values -- using it -- exhaust gas -- a conduit -- the exhaust gas characterized by proofreading an inner temperature sensor -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 2] It is the proofreading method of the temperature sensor arranged inside. a sensor element and sensor housing -- having -- the exhaust gas of a motor vehicle -- a conduit -- Other at least one temperature sensor is arranged as a criteria sensor, without contacting exhaust gas and directly. Therefore, protect from aging, make almost the same temperature of the temperature sensor which should be proofread by that cause, and a criteria sensor at least at the single arbitrary times, calculate a difference from the above-mentioned temperature, and a difference is used. exhaust gas -- a conduit -- the exhaust gas characterized by proofreading an inner temperature sensor -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 3] the exhaust gas according to claim 2 with which the aforementioned criteria sensor is arranged in sensor housing of the temperature sensor which should be proofread -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 4] the exhaust gas according to claim 2 with which the aforementioned criteria sensor is arranged the inside of the electrical connection unit of the temperature sensor which should be proofread, or near the electrical connection unit -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 5] the exhaust gas according to claim 2 made as [work / as an exterior air temperature sensor / simultaneously / this reference-temperature sensor / the aforementioned criteria sensor is arranged on a motor vehicle, and] -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 6] the exhaust gas according to claim 2 made as [work / as a cabin air-temperature sensor / simultaneously / this criteria sensor / the aforementioned criteria sensor is arranged on vehicles and] -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 7] the exhaust gas according to claim 2 arranged in the space in the motor vehicle with which the aforementioned criteria sensor was filled up with the liquid -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 8] the exhaust gas according to claim 7 with which the aforementioned criteria sensor is arranged in the cooling water of a motor vehicle -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 9] the exhaust gas according to claim 7 with which the aforementioned criteria sensor is

arranged in the engine oil in a motor vehicle -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 10] It is the proofreading method of the temperature sensor arranged inside. a sensor element -- having -- the exhaust gas of a motor vehicle -- a conduit -- The maximum of the temperature sensor constituted identically, and the behavior of the minimum time aging Based on the electric parameter of the temperature sensor constituted identically, it checks beforehand. the behavior of checked aging -- software -- memorizing -- and the exhaust gas of a motor vehicle -- a conduit -- the exhaust gas of the motor vehicle characterized by this proofreading the temperature sensor arranged inside -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 11] the exhaust gas of the motor vehicle according to claim 10 with which the aforementioned temperature sensor is constituted as a resistance temperature sensor, and the resistance is used as an electric parameter -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 12] the exhaust gas of the motor vehicle according to claim 11 with which the sensor element of a resistance temperature sensor is constituted as a metallic resistor or a NTC resistor or a PTC resistor -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 13] the exhaust gas of the motor vehicle according to claim 12 with which a platinum resistor is used as the aforementioned metallic resistor -- a conduit -- the proofreading method of the temperature sensor arranged inside

[Claim 14] the exhaust gas of the motor vehicle according to claim 10 with which the aforementioned temperature sensor is constituted as a thermocouple, and thermoelectromotive force is used as an electrical parameter -- a conduit -- the proofreading method of the temperature sensor arranged inside

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention -- the exhaust gas of a motor vehicle -- a conduit -- it is especially related with this three kind of method about the method for proofreading the temperature sensor arranged inside

[0002]

[Description of the Prior Art] the exhaust gas of a motor vehicle -- a conduit -- the temperature sensor for measuring inner exhaust gas temperature directly is common knowledge. In this arrangement, the sensor element of a temperature sensor is *(ed) by the extreme temperature change in the exhaust gas of a motor vehicle, and the corrosive component, and this brings about aging of a sensor element, and the drift of a sensor signal. For example, although hydrogen is considered to be one of the corrosive components, this may be diffused during metal sensor housing generally used for protecting a sensor element, or glass casing.

[0003] German patent DE 37 33 192 No. has described this problem about the PTC (positive temperature coefficient) temperature sensor. In this patent, aging of a PTC temperature sensor element sinters it between ceramic sheets, and is completely prevented by covering from exhaust gas. In this arrangement, in spite of it, when it originates in disclosure and aging of PTC temperature arises, a problem arises first. Such aging is detected, and is not acquired but the incorrect measurement which is not recognized is produced.

[0004] However, the temperature sensor of other form, for example, a NTC (negative temperature coefficient) temperature sensor element, a metal resistance element, or a temperature sensor like a thermocouple also receives aging, when used within the exhaust gas of a motor vehicle.

[0005]

[Problem(s) to be Solved by the Invention] this invention -- the exhaust gas of a motor vehicle -- a conduit -- it is a method for proofreading the temperature sensor arranged inside, and is based on the problem which is going to offer this various kind that extends the usefulness of a temperature sensor and increases the precision of a thermometry of method

[0006] The method of this invention is suitable to live the service life of the actually aged temperature sensor element long, and this does not need the exchange influenced by aging of a temperature sensor to all the lives of a motor vehicle. It depends for selection and the frequency of use of a method only on the accuracy of measurement needed about the selected temperature sensor.

[0007]

[Means for Solving the Problem] The 1st method of this invention for proofreading this kind of temperature sensor. It is what uses the catalytic converter arranged inside. the exhaust gas of a motor vehicle -- a conduit -- Leave the start between the colds and transition of temperature is measured on the lower stream of a river of a catalytic converter within a catalytic converter. the plateau value of the temperature beforehand measured by the proofread sensor or new temperature sensor in the temperature value which decides the plateau of temperature by that cause, and by which the plateau of temperature was measured -- comparing -- and the

difference of a value -- exhaust gas -- a conduit -- it is the method of using it for proofreading an inner temperature sensor

[0008] this specification -- setting -- the start between the colds -- the exhaust gas of a motor vehicle -- a conduit is within the limits of ambient temperature, and should be understood to be the conditions which do not exceed about +50 degrees C

[0009] The method of this invention uses the knowledge of having a characteristic temperature rise accompanied by the plateau where the catalytic converter for purifying exhaust gas or reducing nitrogen oxide does not change during the time when temperature is short following the start between the colds (referring to drawing 1). the inside of the limitation that this plateau is narrow -- setting -- a remarkable long period -- the specific temperature value which appears again and again on the same level is said A deer is carried out and this value depends for the inside of a catalyst on the specific surface area the dew-point of the flowing exhaust gas, and inside a catalytic converter. Of course, situations differ about the temperature gradient between the length of a plateau therefore the start point of a plateau, and exhaust gas [in / the ending point of a plateau / especially], and a plateau. Therefore, only the temperature value of a plateau is an almost fixed size, and can use this because of comparison.

[0010] the check of this temperature value of a plateau -- the form of a catalytic converter, and exhaust gas -- according to arrangement of the temperature sensor in a conduit, it must be carried out separately, you may carry out using a separate testing device, and even the start between the colds of the beginning of a new motor vehicle can be performed by forming the average, for example As the mass of determination with which the catalytic converter of the temperature sensor upstream is heated is large, it is easier by suitability. because, the length of a plateau -- and it is because it is obtained Although the temperature value with which the plateau was checked may be memorized subsequently to the software of a motor vehicle, this software must be put on a proper place so that the time of elevation temperature transition of a catalytic converter being located in a plateau may be determined. The value memorized at this time is compared with the temperature value by which the present of the temperature sensor which should be proofread was measured, and a difference is calculated. A temperature sensor will be proofread, if the selectable allowed-band region which needs this difference for a precision required for such a thermometry is passed or it is insufficient to it.

[0011] In the 2nd method of this invention for proofreading the temperature sensor of the general format which has a sensor element and sensor housing Other at least one temperature sensor element is arranged as a criteria sensor in the state where it was protected from aging, without [therefore] contacting exhaust gas and directly. the temperature of the temperature sensor which should be proofread, and a criteria sensor -- time it is single at least -- almost -- the same -- carrying out -- subsequently -- temperature to a difference -- calculating -- this difference -- exhaust gas -- a conduit -- it uses so that an inner temperature sensor may be proofread

[0012] Here, in this specification, or it is as new as "almost the same", deflection should be understood to be what is in the range of **1 degree K without ***** desirable completely again between two temperature measured by the proofread temperature sensor. If it is known beforehand even if the temperature at a certain time and the temperature distribution between criteria sensors are more high, it is usable and can remove using a calculation routine.

[0013] When temperature may be measured, it can choose immediately after starting of the engine of a motor vehicle which all has elegance in ambient temperature. However, it is also possible to perform relative measurement working [an engine] at a certain time after a stop of vehicles.

[0014] The measurable difference in which it may be between temperature-gradient signals when it is always found out that a temperature sensor and a criteria sensor are in the same temperature level according to experience at a certain time expresses the direct scale over aging of a temperature sensor. A temperature sensor will be proofread if this difference is on the allowed-band region which may be chosen according to the required accuracy of this kind of thermometry, or in the bottom. However, proofreading can be omitted if a difference is in tolerance.

[0015] The measurable difference between temperature signals is the only feature which shows aging of a temperature sensor, if it is always found out that a temperature sensor and a criteria sensor are in two different temperature level, however the temperature level from which fixed level deflection differs mutually from experience and it will exceed fixed deflection + tolerance, or if it is below a fixed deflection-allowed-band region.

[0016] A criteria sensor can be arranged in the place where it changes in a motor vehicle and on a motor vehicle most. It is advantageous to be arranged the inside of sensor housing of the temperature sensor which should be proofread, or the electrical connection unit of the temperature sensor which should be proofread, or near the electrical connection unit. You may arrange a criteria sensor on a motor vehicle again so that it may work as an exterior air temperature sensor simultaneously. Similarly, it is also advantageous to arrange a criteria sensor in a motor vehicle. In this case, a criteria sensor can act as a cabin air-temperature sensor simultaneously.

[0017] Arranging a criteria sensor in the space in the motor vehicle which filled the liquid, for example, cooling water, and an engine oil is considered the same way.

[0018] The 2nd method brings about the most exact proofreading result as compared with other two proposed proofreading methods.

[0019] the behavior of aging which opted for the maximum of the temperature sensor constituted identically, and the behavior of the minimum time aging beforehand based on the electrical parameter of the temperature sensor constituted identically, and was checked in the 3rd method of this invention which proofreads the temperature sensor of the general format which has a sensor element -- software -- memorizing -- thereby -- the exhaust gas of a motor vehicle -- a conduit -- the temperature sensor arranged inside is proofread

[0020] A large number about a desired temperature sensor element need prior to be experimented for this method. Here, in order to determine transition of the aging the minimum [about the time of a sensor element] and greatest, the test conditions (exhaust gas composition, temperature, etc.) which load a sensor element to the minimum in one side, and load it to the maximum in another side are chosen. so that transition of the aging the minimum [about the time of a sensor element] and greatest is approaching -- the exhaust gas of a motor vehicle -- a conduit -- an inner temperature sensor can be proofread more to accuracy later

[0021] A temperature sensor may be constituted as a resistance temperature sensor, and the resistance can be used as an electrical parameter. You may constitute the sensor element of a resistance temperature sensor as a metallic resistor or a NTC resistor or a PTC resistor. In this case, a platinum resistor is advantageously used as a metallic resistor.

[0022] Furthermore, a temperature sensor can be constituted as a thermocouple and thermoelectromotive force can also be used as an electrical parameter.

[0023]

[Embodiments of the Invention] Hereafter, the method of this invention is explained in detail about an example based on drawing 1 -4. drawing 1 -- the exhaust gas of a motor vehicle -- a conduit -- transition of the temperature of the catalytic converter which is inside is shown, and equipment can be used for enforcing the method of a claim 1 Transition of temperature is theoretically applicable to an alien system depending on arrangement of the temperature sensor in the form of the structure of a catalytic converter, and a catalytic converter, and on a catalytic converter therefore. Curves 1 and 2 show temperature transition of the catalytic converter under start between [of two] the colds of a motor vehicle, lap mutually and are recorded. Although a plateau is recorded also in which given example following the rapid rise of the temperature to about 50 degrees C, if temperature is in this example for several seconds, in a plateau, temperature stops at the same state over about 15 seconds. Depending on the dew-point of the exhaust gas which flows the inside of a catalytic converter, since the temperature sensor in a motor vehicle is proofread, the level of a plateau can be used as an almost fixed size.

[0024] The example with the temperature sensor which can be used for drawing 2 enforcing a method according to claim 2 of several sorts of measuring devices is shown. the exhaust gas of a motor vehicle -- in the conduit 1, exhaust gas is flowing at temperature T_e exhaust gas -- a

conduit -- inside, the temperature sensor element 2 with sensor housing is formed, and the temperature T_e of exhaust gas is decided now exhaust gas -- the electrical connection unit 3 to the temperature sensor element 2 is arranged on the outside of a conduit 1 at the motor vehicle top in a motor vehicle here -- exhaust gas -- you may arrange other temperature sensor elements in the state where it was protected from aging by exhaust gas on the outside of a conduit 1 in this way -- for example, exhaust gas -- the outside of a conduit 1, and exhaust gas -- the electrical connection unit 3 of the inside near the conduit 1 -- temperature T_a -- you may record -- exhaust gas -- you may record temperature T_a' in the distance which is separated from a conduit 1 a little. Instead, you may record temperature T'' for example, in the cooling water container 4 of a motor vehicle.

[0025] Drawing 3 has presented the measurement result of the equipment which follows drawing 2 as an example, and temperature T_e and T_a is measured. There is a motor vehicle, respectively, and a time period operation is carried out and it has an operation for four starts (numbers 1-4) of an engine to be performed, and finally suspended. exhaust gas -- a conduit -- the temperature T_e measured inside -- exhaust gas -- each other is offset by calculation of a difference with the temperature T_a measured on the outside of a conduit, and value $T_e - T_a$ is obtained. This value $T_e - T_a$ is taken into consideration about the suspended vehicles. value $T_e - T_a$ -- exhaust gas -- a conduit -- the scale of aging of an inner temperature sensor element is expressed, and it is usable according to the requirements for the accuracy of measurement of this sensor element because of the proofreading. For example, if a ± 1 -degree K temperature gradient may be permitted, it will be determined by computer electronic system whether there is measured-value-ed $T_e - T_a$ inside an allowed-band region, or it is outside. In this case, if the size of $T_e - T_a$ is smaller than 1, the temperature gradient between both temperature sensor elements is 1 degree K or less, and proofreading is not needed yet. On the other hand, if the size of value $T_e - T_a$ is larger than 1, the temperature sensor element in exhaust gas will be proofread by value $T_e - T_a$, and will be made to suit by the measured temperature T_a of the temperature sensor element with which only value $T_e - T_a$ has been arranged out of exhaust gas. Such computer-processing of measured value-ed is clear to this contractor.

[0026] the temperature sensor in which drawing 4 has a platinum resistance element as a sensor element -- the operating time of 500 hours -- crossing -- the exhaust gas of a motor vehicle -- a conduit -- prediction of the average temperature drift (degree C) of this temperature sensor in the case of having been arranged inside is shown. With a temperature drift, it is understood as the difference between a measured temperature value and the actually governed temperature. An average temperature drift means the usual maximum of a sensor element, and average aging during the minimum aging. In the case of the temperature sensor which has a platinum resistance element as a sensor element, it is thought that most incorrect measurement results from the increase in the electric resistance of the platinum resistance element resulting from aging. Theoretically, the curve illustrated by drawing 4 can be beforehand checked about one of each of the temperature sensor form based on a prolonged examination, is recorded in the electronic instrument on a motor vehicle, and is applicable to proofreading of this kind of temperature sensor.

[0027] As mentioned above, although this invention was explained about the desirable example, if it is this contractor, you can understand that various deformation and change can be thought of from that by which illustration explanation is given here, without deviating from the technical thought of this invention.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] the exhaust gas in a motor vehicle — a conduit — it is the graph which shows temperature transition of the catalytic converter following the start between the colds of the catalytic converter which is inside

[Drawing 2] It is the diagram showing the equipment which has the temperature sensor element protected in aging.

[Drawing 3] It is a graph about the temperature measured according to the measuring device of drawing 2.

[Drawing 4] the exhaust gas of a motor vehicle — a conduit — it is the graph which predicts the temperature drift of the temperature sensor which is inside

[Description of Notations]

1 Exhaust Gas — Conduit

2 Temperature Sensor Element

3 Electrical Installation Unit

Ta, Ta', Ta~ Temperature

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